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by Hasina Rasata

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Industrial capacity utilization rates – Sources and methods

by **Hasina Rasata**

What is the ICUR program and how is it used?

The Industrial capacity utilization rate (ICUR) is the ratio of an industry's actual output to its estimated potential output—it represents the intensity with which industries use their production capacity. The rate provides insight into the overall slack that is in the economy or a firm at a given point in time.

In practice, Statistics Canada's ICUR estimates reflect the utilization of capital. The rates are produced quarterly covering all goods-producing industries (except agriculture) including all manufacturing industries and selected non-manufacturing industries. They are produced through a combination of survey data and statistical modeling. In the past, manufacturing industries' annual estimates were obtained from an annual survey, while the quarterly pattern was based on derived output-to-capital ratios. For non-manufacturing industries, real gross domestic product (GDP) and real capital stock are used to derive output-to-capital ratios.

What changes have been made to the ICUR program?

Since 2016, the Monthly Survey of Manufacturing (MSM) has been collecting data on capacity utilization rates for manufacturing industries. ICUR is computed by dividing the current dollar production of an industry by its current dollar production capacity. Use of MSM data is preferred to an annual estimate because the former improves both timeliness and accuracy of the indicator. The first monthly estimates of manufacturing ICUR were released on July 17, 2018, beginning with reference period January 2017.

These new monthly manufacturing ICUR estimates have now been integrated into the Canadian System of Macroeconomic Accounts (CSMA) quarterly ICUR program as an updated input data source. Both the ICUR estimates and the underlying methodology for all non-manufacturing industries remain unchanged—the main improvement is in the increased data frequency.

For consistency, the aggregation of the manufacturing industries differs slightly from the approach used by the monthly manufacturing program. The MSM aggregates capacity utilization rates based on production capacity weights from each sub-industry. The latter is obtained by dividing the production by the corresponding capacity use rate. To generate the potential output of each industry, the current quarterly program aggregates the ratios of real GDP to the capacity rate of the industry. The real GDP by industry is then summed to the level of the desired aggregate and divided by the corresponding sum of the potential output to derive the rate of capacity use at the aggregate level.

How is ICUR calculated?

ICUR calculations involve incorporating monthly data, which are ultimately benchmarked to annual estimates, and are then projected using monthly real GDP by industry and net capital stock, both for manufacturing and non-manufacturing industries. This methodology has been updated as the practice up to 2015 was to use annual data from the Annual Survey of Manufacturing and Logging (ASML), which asked: *"For the reporting period of YYYY MM DD to YYYY MM DD, this business has been operating at what percentage of its capacity?"* The percentage is derived by taking the actual production level (measured in dollars or units) and dividing it by its capacity production level, where capacity production is defined as the maximum production attainable under normal conditions. Normal operating conditions may include overtime, shift work, holidays, etc. This question was removed from the annual survey and transferred to the monthly questionnaire.

For the **manufacturing industries**, a quadratic minimization technique is applied to convert annual benchmarks to quarterly measures using the quarterly output-to-capital ratios. Annual benchmark levels of capacity use are supplemented with other economic activity information (such as production, hours worked). The output-to-capital ratios are based on the real GDP by industry and real net hyperbolic capital stock.

The sector level aggregation relies on the ratio of real GDP and the rate of capacity to create estimates of potential output per industry. Real GDP by industry is then summed to the level of the desired aggregate and divided by the corresponding sum of the potential output to derive the rate of capacity use at the aggregate level.

For non-manufacturing industries, the measures of actual output are the measures of real GDP at basic prices, seasonally adjusted by industry. The measures of potential output are derived from the stock and consumption of fixed capital program in the CSMA. Estimates are confronted against other economic indicators, such as production and hours worked. The seasonal adjustments of ratios are performed using seasonally adjusted real GDP.

Aggregation is done using real GDP and the rate of capacity use to create estimates of potential output per industry. Real GDP by industry is then summed to the level of the desired aggregate and divided by the corresponding sum of the potential output to derive the rate of capacity use at aggregate level, similar to the approach used for manufacturing industries.

How has the new monthly data been integrated into the existing series?

These new monthly manufacturing ICUR estimates have been integrated into the CSMA quarterly ICUR program as an updated input data source as of the second quarter of 2018 (reference period beginning January 2017). The following outlines the integration issues that are currently being examined.

Monthly ICUR data received from the MSM program are not yet **seasonally adjusted** due to the lack of a sufficiently long time series as at least five years of data is required for conducting seasonal adjustment. Hence the current estimates are raw and can be subject to a higher month-to-month volatility. However, the CSMA is investigating three approaches to produce an alternate seasonally adjusted series.

The first two approaches are based on the use of an annual benchmark level as the actual methodology with slightly different applications. The quarterly pattern was derived using the output-to-capital ratio distribution, which by nature of its calculation is already seasonally adjusted.

The first approach applies the year-over-year growth rate to extrapolate manufacturing ICUR as the full year data is not available. This option differs slightly from the actual methodology used to project the manufacturing ICUR data when an annual benchmark level is not yet available.

The second approach uses the annual average of monthly manufacturing ICUR data as the annual benchmark level. The non-benchmarked quarters are then projected using the movement in output-to-capital ratios.

The third approach uses the implicit seasonal factors from constant dollar production and applies them to the raw monthly manufacturing ICUR data to obtain a seasonally adjusted series. This last option assumes, implicitly, that production capacity does not have seasonal patterns. However, the raw MSM data exhibits volatility in its capacity series.

None of the approaches provide a conclusive result for all sub-industries. In particular, several lower weighted manufacturing industries continue to show significant variability after applying each of the three seasonality correction approaches. As such, seasonal adjustment of the monthly ICUR series is not resolved and further investigation is warranted once a longer time series becomes available.

How is the quarterly ICUR program backcasted?

For now, the existing quarterly CSMA program will integrate the monthly ICUR estimates as an updated input data source starting with the first quarter of 2017 reference period. The monthly estimates will be quarterized by simply taking the arithmetic average of the three months.

Several implementation options have been considered in order to backcast the quarterly ICUR series in order to maintain a long term and continuous time series. A few options have been evaluated, all of which require a revision of the level of the published survey-based ICUR estimates. In most cases, the level of the new monthly manufacturing estimates are lower than the published data. Therefore, any linking approach will lead to a downward level shift of the quarterly ICUR series.

The first option involves linking the quarterly program with the average of the new 2017 MSM estimates and backcasting using the published annual averages. This option has the benefit of removing seasonality and is similar to the previous process for manufacturing when an annual benchmark is used. However, it causes revised quarterly growth rates.

The second option involves linking with a specific time period from the new MSM estimates and backcasting using the published quarterly growth rates. A few start dates were considered:

- replace the fourth quarter of 2016 with the average of the third and fourth quarters of 2016 from MSM;
- replace the first quarter of 2017 with the first quarter of 2017 MSM data.

While this option is conceptually simpler, it has two main drawbacks. The historical level is heavily influenced by the quarter chosen from new MSM ICUR estimates. Additionally, the level of the adjusted series varied with the chosen quarter.

Two technical issues should also be considered. First, in the absence of an overlap period between the monthly and annual data, reconciling them is problematic. Secondly, as the ICUR questionnaire has been changed from the annual to the monthly survey, the resulting two sets of estimates may differ by construction. In fact, even minor changes in question wording, question order or response format may result in differences in the type of response obtained.

In summary, without additional information the CSMA has directly integrated the new monthly manufacturing estimates without any adjustments to the back period.

Has the ICUR aggregation changed as a result?

The aggregation of the quarterly ICUR program for manufacturing industries will differ slightly from the approach used by the monthly manufacturing program. This approach is preferred because it maintains consistency with the aggregation of the non-manufacturing industries, which are unaffected by the incorporation of monthly data.

The MSM program aggregates based on production capacity weights from each sub-industry. This is obtained by dividing the production by the corresponding capacity use rate. The current CSMA quarterly ICUR program aggregation is based on the ratio of real GDP and the rate of capacity use to create estimates of potential output per industry. Real GDP by industry is then summed to the level of the desired aggregate and divided by the corresponding sum of the potential output to derive the rate of capacity use at the aggregate level.